

Feb. 6, 1962

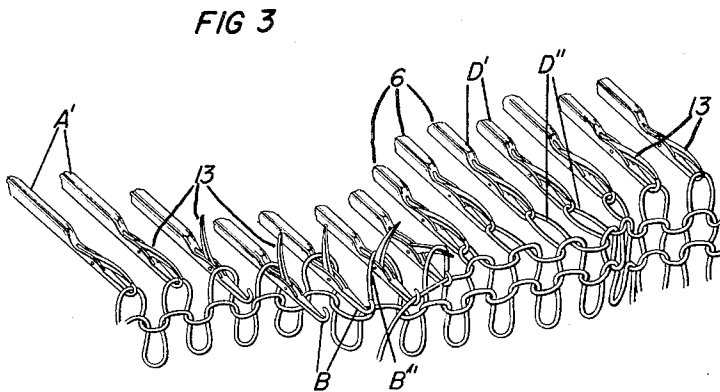
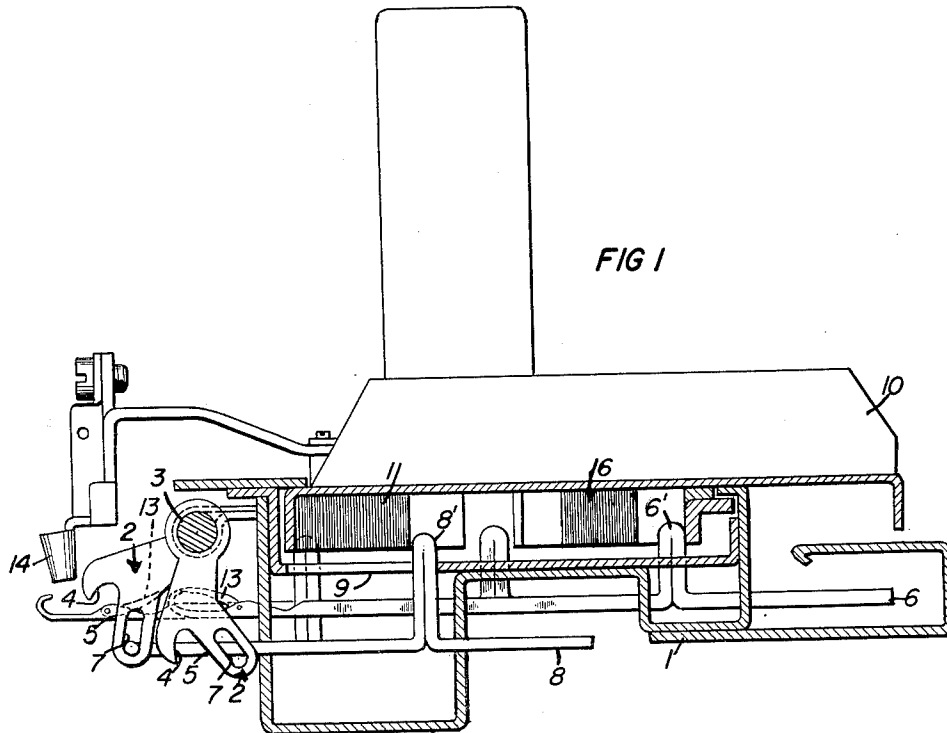
SANJI HORI

3,019,624

MOVING NEEDLE TYPE HAND OPERATED KNITTING MACHINE

Filed May 28, 1958

4 Sheets-Sheet 1

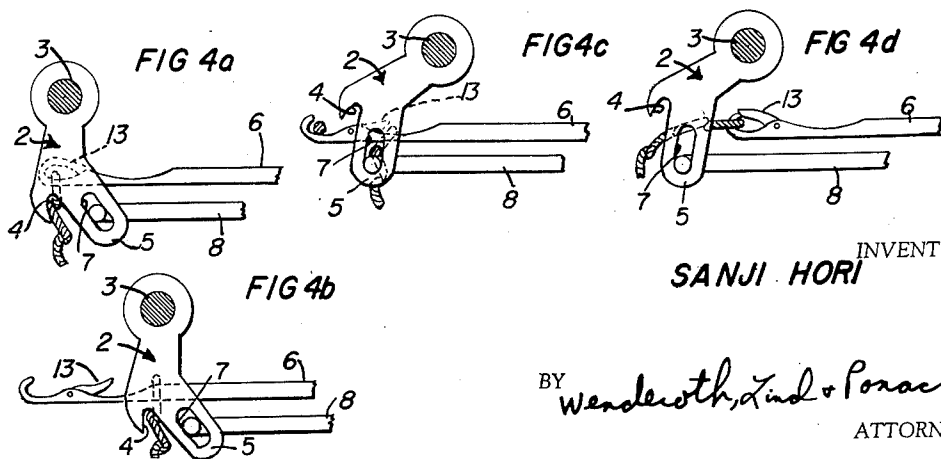
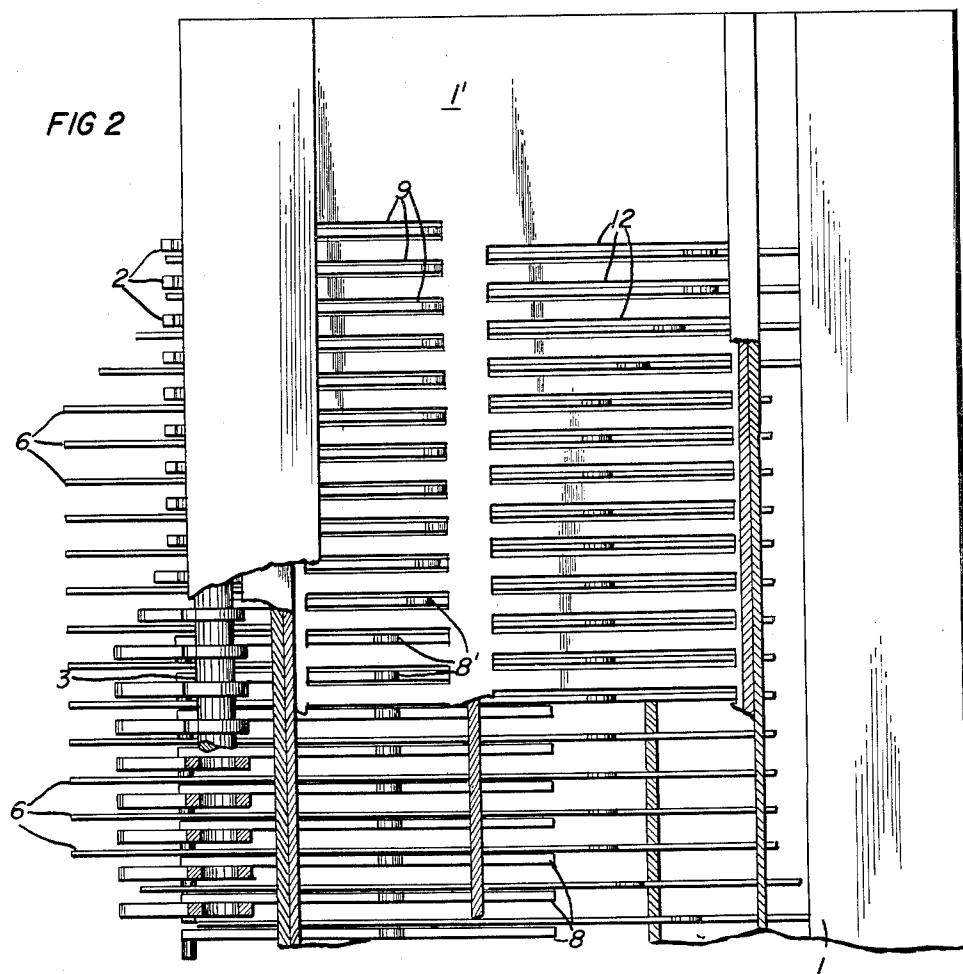


SANJI HORI INVENTOR

BY *Wendeloth, Lind & Ponack*  
ATTORNEYS

**3,019,624**

4 Sheets-Sheet 2



INVENTOR

**SANJI HORI**

BY *Wendroth, Lind & Porack*  
ATTORNEYS

Feb. 6, 1962

SANJI HORI

3,019,624

MOVING NEEDLE TYPE HAND OPERATED KNITTING MACHINE

Filed May 28, 1958

4 Sheets-Sheet 3

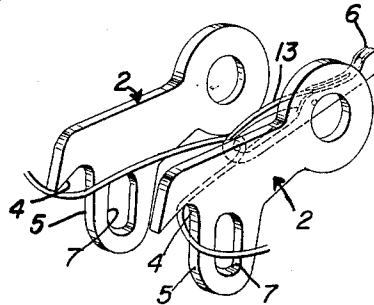
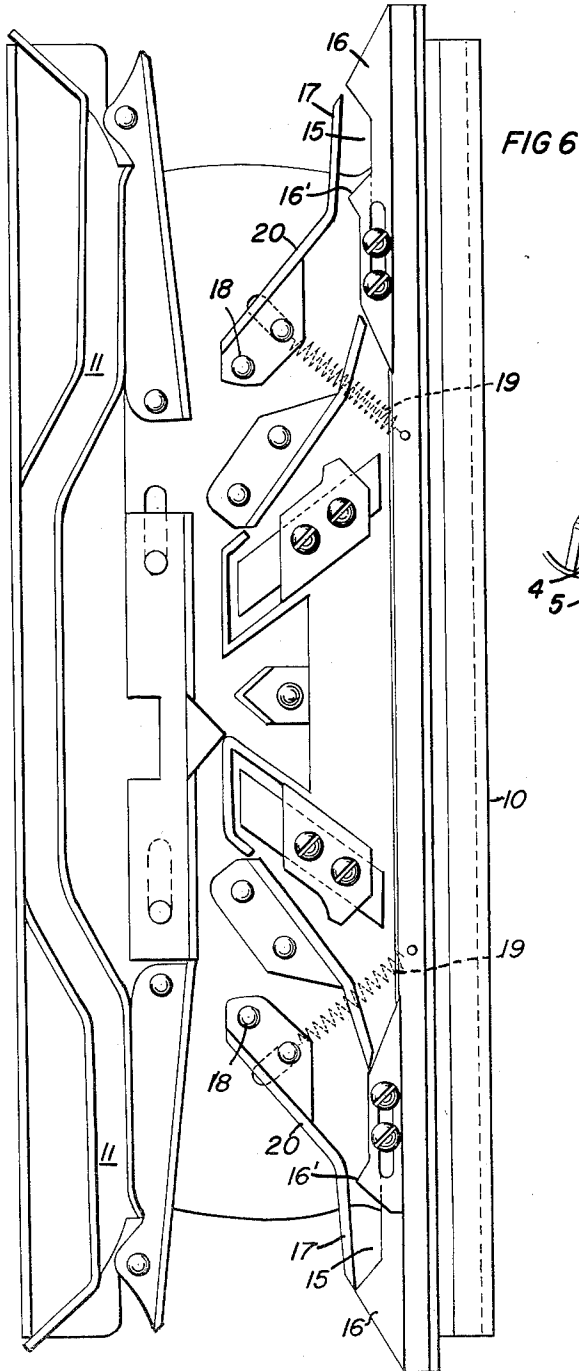


FIG 5

INVENTOR  
SANJI HORI

BY *Wendeloth, Lind & Honack*  
ATTORNEYS

Feb. 6, 1962

SANJI HORI

3,019,624

MOVING NEEDLE TYPE HAND OPERATED KNITTING MACHINE

Filed May 28, 1958

4 Sheets-Sheet 4

FIG 7

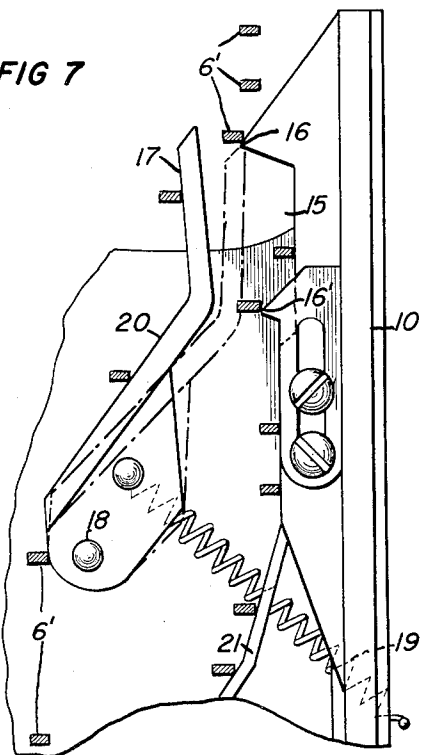


FIG 8

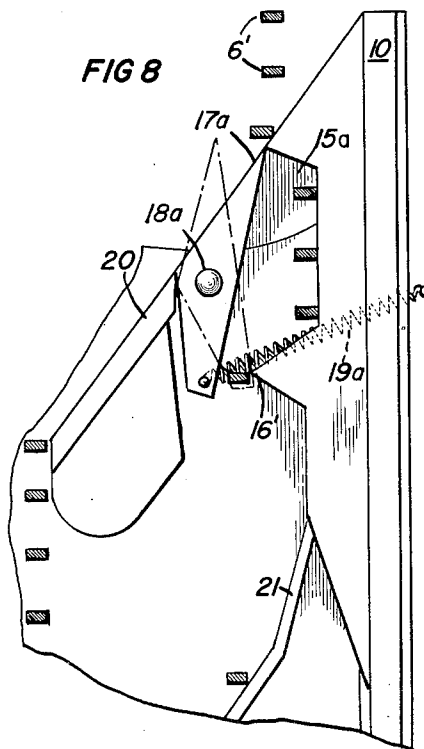
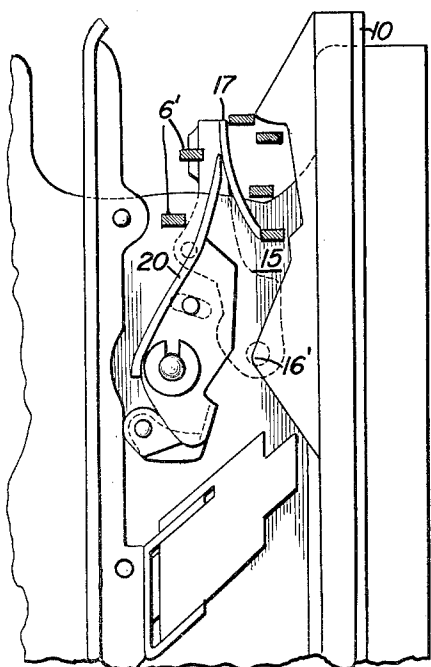


FIG 9



SANJI HORI INVENTOR

BY *Wendroth Lind & Bonack*  
ATTORNEYS

1

3,019,624

## MOVING NEEDLE TYPE HAND OPERATED KNITTING MACHINE

Sanji Hori, 3-4 Nakasako-cho, Tokushima, Japan  
Filed May 28, 1958, Ser. No. 738,465

Claims priority, application Japan Nov. 11, 1957  
8 Claims. (Cl. 66-60)

This invention relates to a moving needle type of hand operated knitting machine.

Existing moving needle types of hand operated knitting machines must make fabric by operating only knitting needles which protrude completely out of the fabric, the position of which is firmly fixed, so that the knitting needles across the entire width of the fabric may be moved. For that reason, together with the limitations resulting from the nature of the machine which has long rows of closely adjacent holes indispensable to a hand knitting machine, it is easily damaged and worn out. Since the knitting needles across the entire width area must be operated, considerable labor is needed to operate a machine of this kind. In making fabric, an excessive load on the yarns is liable to damage the material and the yarns, which makes it impossible to manufacture finished goods which are elastic and fluffy.

Incidentally, in order to knit a special pattern such as tuck knitting with an existing carriage, there must be provided a special comb-like needle picking plate to push aside projecting needle rows according to the pattern desired before the machine is operated. Therefore, there must be provided a special comb-like needle picking plate for each of the many patterns desired. Moreover, knitting and needle picking operations delay the progress of a carriage, which results in high expenses for labor and low efficiency.

In mounting an existing machine, a rigid support is needed to locate a sub knitting needle (unless left and right sub knitting needles are located symmetrically, it is impossible to make finished goods with the desired fabric width), and a special technique is needed to operate the machine speedily.

This present invention does away with these handicaps, moving the fabric itself forward and rearward, which cuts down the extent of needle movement. A shortened needle bed length reduces the likelihood of damage to the frame, thus prolonging the life of the newly invented machine.

This machine reduces considerably the labor needed in operating an existing machine and makes it easy to operate so as to produce goods which are elastic and fluffy without damaging the yarns of the material. This machine can automatically pick up as many needles as desired out of a needle butt row without a special comb-like needle picker, making the progress of the carriage the same as the amount of work, so that the expensive labor needed in the operation of machine is considerably reduced and the efficiency is increased considerably. A sinker cam bed which operates a movable member mounted transversely of the machine makes it easy to provide a sub knitting needle for this machine so that it can knit a fabric of exactly the desired fabric width.

On the front of the machine according to the invention may be installed knitting needles and sinkers equipped with a neb and a controller to remove loops. The advance and retreat of the fabric occurs under the effect of the back and forth movement of a pushing plate, and when the fabric is in the rear position the knitting needles project out therethrough, and then the fabric retreats.

By repeating such a process, the knitted fabric can be produced. The special merit of this invention lies in making use of the interval between the back and forth

2

movement of the fabric. The movement of the knitting needles is also considerably reduced, which contributes to prolonging the life of the frame and also makes the machine durable and machine-handling easy, giving finished goods which are elastic and fluffy.

On the front end of the carriage is provided a recess which will admit a given number of knitting needle butts and the entrance to which is made to open and to shut. When knitting needle butts held in this recess try to get out of it, the entrance either opens or shuts to pick up knitting needles from the ones passing the recess to cause them to enter the recess. There is no need to pick up all the knitting needles out of a row on the needle bed beforehand. It is sufficient only to admit a given number of needle butts to prepare to pick up, and the remaining necessary pick ups will be made automatically by the machine itself during the movement of the carriage.

A further detailed explanation of this invention will be made in the following description taken together with the appended drawings in which:

FIG. 1 is a vertical section through a machine according to the invention;

FIG. 2 is a partial plan view of the machine of FIG. 1;

FIG. 3 is a perspective view of a needle row;

FIGS. 4a-4d are side views showing the order of operation both of the sinker and the knitting needles;

FIG. 5 is a perspective view showing the relation between the sinker and the knitting needle in making fabric;

FIG. 6 is an enlarged plan view of a carriage;

FIG. 7 is a detail view of an essential part of the operating carriage;

FIG. 8 is a detail view of a modified form of pick up member showing its alternative position in dotted lines; and

FIG. 9 is a detail view of the pressing lever showing its alternative position in dotted lines.

A bar 3 is mounted on the upper front portion of the frame 1. Rotatably mounted on the bar 3 are a plurality of sinkers 2 having a neb 4 thereon and a controller 5 to remove loops. Knitting needles 6 are provided which pass between adjacent sinkers 2.

Every controller 5 has therein an elongated hole 7 in which is engaged one end of sinker needles 8.

Sinker needles 8 have butts 8' thereon projecting through elongated slots 9 in plate 1' of frame 1.

The butts 8' slide in cam groove 11 in a needle actuating carriage 10. Knitting needles 6 have butts 6' protruding through slots 12 in plate 1'. Slots 12 lie in a line parallel to the line of slots 9. Butts 6' contact several cams mounted generally parallel to cam slot 11.

Each knitting needle 6 has a latch 13 thereon, and each knitting needle 6 passes under a yarn feeder 14. Both ends of carriage 10 have a recess 15 which will hold a given number of knitting needle butts 6'. The outer end of the recess 15 has an entrance barrier 16 and the inner end has an exit barrier 16'. A pressing lever 17 is pivotally mounted on pivot 18 and spring loaded by spring 19 so the one end of a portion of the pressing lever 17 which extends parallel to the length of recess 15 bears against the entrance barrier 16. The other end of the portion of the pressing lever 17 bears against the exit barrier 16'.

With this structure, when the knitting needle butts 6' which are in the recess 15 push up the rear end of the portion of pressing lever 17 to pass over the exit barrier 16' the front end of pressing lever is raised from the entrance barrier 16 to open it (FIG. 7). The opening and shutting of the entrance barrier divide the path to be followed by knitting needle butts 6'.

Pressing lever 17 has a tucking up cam portion 20 thereon and shift cam 21 is mounted adjacent the exit

3

barrier 16' so that the knitting needle butts leaving recess 15 will engage it. The butts 6' are thus led by two different paths to the same point.

The machine constructed as above described will operate as follows: movement of carriage 10 will cause sinker needles 8 and knitting needles 6 to move in and out (to the left and right in FIGS. 1, 2 and 4), the sinker needles 8 moved by engagement of butts 8 in cam slot 11 and needles 6 by engagement of butts 6' with cams 20 and 21, the sinker 2 will be pivoted around bar 3 by the front end of the sinker needles 8. The order of the movements of sinker 2 and knitting needles 6 is shown in FIGS. 4a-4d.

As seen in FIG. 4a, the knitting needle first projects past the fabric, the fabric being held in position by neb 4 on the sinker 2, and the knitting needle will move through the fabric until the latch 13 on knitting needle has passed through the fabric.

Then, sinker 2 will be rotated by sinker needle 8 moved by cam slot 11 so as to revolve around the bar 3 and the fabric loop under the neb 4 will be pushed forward by the controller 5 to remove a loop of fabric from the sinker 2 and to move to a position as seen in FIG. 4c. In this position the fabric has been moved forward as seen in FIG. 3.

Then, the hook of needle 6 will be fed a yarn by yarn feeder 14 and knitting needle 6 will retreat to its former position as seen in FIG. 4d.

However, when knitting needle 6 has retreated, sinker 2 still remains in the extended position with a loop of yarn between neb 4 and controller 5 (see FIG. 5). Only the knitting needles will retreat, and these will move a distance only as far as they originally moved forward.

Finally, sinker 2 is moved to the position of FIG. 4a by sinker needle 8 engaged in cam slot 11, and neb 4 tucks up the fabric. Thus, first the knitting needle 6 moves and then sinker 2 moves, and the distance of the movement of knitting needle 6 is shortened by a distance equal to the distance the fabric is pushed by sinker 2, which in turn reduces the stroke of the knitting needle 6. In the case of existing moving needle type machines, the position of the fabric is fixed and only the knitting needle comes out through the fabric. The length of movement of the knitting needle is equal to the length sufficient to fully open the latch of the knitting needle after the knitting needle protrudes out of a fabric plus a length sufficient to draw the knitting needle out of the fabric on its return stroke.

The present machine, on the contrary, causes the knitting needle 6 to protrude only sufficiently far to pass latch 13 of the knitting needle 6 through the fabric, which stands still, and then the fabric is moved in the same direction as the needle and remains in its new position and lets the knitting needle 6 be withdrawn.

Therefore, in comparison with an existing machine in which the fabric is in a fixed position, the distance through which the knitting needle moves is shortened at least as much as the fabric advances. If the length of the fabric which is moved is about equal to the length of the stitch, it will be enough for the knitting needle 6 to move a distance just sufficient to pass the latch 13 through the fabric.

Thus it is seen that by properly operating the machine, the actual distance through which the needles 6 are moved relative to the frame of the machine is less than would ordinarily be sufficient to pass the needles completely through the fabric being knitted. This is because the fabric itself is moved relative to the needles 6 by the sinkers 2.

Starting with both the knitting needle 6 and sinker 2 in the position of FIG. 4a, knitting needle 6 is moved so as to protrude past sinker 2 with the stitch remaining on the fully opened latch 13.

Knitting needle 6 protrudes only a little, as seen in FIG. 4b. Sinker 2 is then rotated to the position as shown in FIG. 4c, and then knitting needle 6 is withdrawn (in

4

this case it contains the length of stitch to be knitted next) and returns to its former position, and the fabric will remain on latch 13 of the knitting needle as formerly. In short, the distance through which knitting needle 6 moves is even shorter than is necessary to pass the latch 13 of knitting needle 6 through the fabric before starting the knitting by moving the carriage.

Furthermore, before starting the knitting operation by moving the carriage, the desired number of needle butts must be admitted to recess 15, and this number must be less than the capacity of the recess. For example, 1-4 needle butts should be admitted if the capacity is five. Then the needle butts get out through exit 16' by sliding up the rear barrier.

To explain the manner in which needle butts get out of the recess 15, reference is made to FIG. 7. The leading butt 6' in the recess pushes up the pressing lever 17 and therefore the front end of the pressing lever 17 moves away from entrance barrier 16 and opens the way into the recess 15 so that only the top of the needle butt closest to the entrance barrier is permitted to enter the recess.

In his case, the work of the top of the butt leaving exit and the movement of the top of the butt entering the recess are achieved concurrently. When one butt has moved out and one has moved into the recess the barriers at both entrance 16 and exit 16' are automatically shut.

The entrance and exit of butts which are the same number of needles apart as the number of butts initially in recess 15 are achieved one at a time, and when all of the butts initially in the recess have moved out of the recess, they will have been replaced by an equal number of butts. If at first two butts are admitted to the recess 15 which has a capacity to admit 4 butts, thus leaving a space for two further butts, even after the carriage starts to move, the recess is not filled because the entrance barrier 16' remains shut.

Therefore, the next succeeding two butts cannot enter the recess 15, and they are led by the cam portion 20 on pressing lever 17 along a second path. When the carriage has moved a distance equal to the space occupied by two butts, the first of the butts in the recess begins to move out of the recess, and at the same time the butt now approaching the entrance barrier is admitted to the recess. As the second butt leaves the recess, a second butt is admitted. This sequence of operations is repeated during the movement of the carriage, a row of knitting needles being automatically led in two paths.

Knitting needles are led along one of the paths by riser cam 20 so as to knit plain knitting or along the other through the recess 15 and along tuck cam 21 so as to knit tuck knitting. Thus desired fancy knitting is achieved automatically.

The modification shown in FIG. 8 is similar to the form of the device shown in FIG. 7 in that by making use of the movement of a butt as it leaves the recess 15a, the opening and closing of the entrance barrier 16 is controlled.

However, pressing lever 17a is spring loaded by spring 19a to the position in which the entrance to recess 15a is normally open, and the butts 6' moving out of the recess 15a cause the pressing lever 17a to pivot about pivot 18a so as to shut the entrance. Therefore, the number of butts which can be caused to move into the recess is limited but the advantage is in being able to hold in the recess as many butts as its capacity permits. In the case of the form shown in FIG. 7, if the capacity of the recess were 4 butts and 4 butts were initially placed therein, as each of these 4 butts moved out of the recess another would be admitted and no butt would be led so as to by-pass the recess.

With the modification of FIG. 8, on the contrary, if the capacity of the recess is 4 butts, even if at first 4 butts were present in the recess, as the entrance is shut by each butt as it leaves the recess, the succeeding 4 butts will be led so as to by-pass the recess, and as soon as the 4 butts

in the recess have left it, the entrance will open and admit the next succeeding 4 butts. In short, all the butts coming to the entrance are caused to take one of two paths by the butts initially present in the recess.

The apparatus according to the invention has many advantages. The distance of movement of the knitting needle is considerably reduced by making the movement of the fabric go back and forth. This brings about the following benefits.

(a) The length of the elongated slots 12 through which the butts 6' of the knitting needles extend may be considerably shortened. The nature of a hand knitting machine as well as its construction necessitates limiting the width of frame.

The existing type of machine is liable to be damaged because the elongated slots are close to each other. On the contrary, in the present machine the shortened slots make it possible to space the slots 12 and the slots 9 farther apart, thereby making the machine more durable.

(b) In operating the machine, the knitting needles and sinkers alternately go in and out. Therefore, the heaviest load, even when a knitting needle must draw a yarn while holding it in its hook to make a new stitch, will be when the sinker, which must absorb a portion of the work available by the reduced movement of the knitting needle, supports the fabric being moved out from its normal position. Consequently, there is little load on the machine.

The advantage gained from the reduction of needle movement is thus by no means offset by the reciprocating movement of the sinker. Almost all of the advantage becomes beneficial to the operation which is thereby made much easier.

(c) In knitting the fabric, when a knitting needle retreats pulling the yarn hooked on its hook, then the fabric will be moved in the same direction by the sinker, and the tension of the yarn will instantly and forceably be released. Thus because the machine operates without a weight on the fabric, which is indispensable to existing machines, the fabric is subjected to no load by the weight.

From these reasons, the yarn is suitably loose. In comparison with finished goods produced by existing machines, the knitting process of which is under continual tension, finished goods by the machine according to the present invention are more elastic and more fluffy, and yarn is not damaged.

(d) To start the machine when it is desired to produce fancy knitting, it is only necessary to let the desired number of needle butts into the recess on the carriage, it being unnecessary to pick up all the needles to prepare the number of butts to be picked up by the movement of the carriage, since the picking up will be achieved automatically by the machine itself, the carriage picking up the desired number of butts out of the row of needle butts.

(e) No comb-like needle picking plate is required, which plate is indispensable to an existing machine.

(f) With the present machine two operations, picking up needle butts and driving the carriage, indispensable to the operation of an existing machine, are reduced to one operation, driving the carriage. This one operation can be adjusted to knit any kind of knitting as quickly and as easily as plain knitting, even special fancy knitting. In comparison with existing machines, the machine according to the invention reduces considerably the expense and labor attendant on its operation, and moreover, increases considerably the operating efficiency.

I claim:

1. A hand knitting machine comprising a frame, a bar mounted on the front of said frame, a plurality of sinkers pivotally mounted on said bar for movement forwardly and rearwardly of said frame, each sinker having a neb and a controller thereon, a plurality of knitting needles slidably mounted on said frame, and a needle actuator movably mounted on said frame for moving said needles and said sinkers in sequence.

2. A hand knitting machine comprising a frame, a bar

mounted on the front of said frame, a plurality of sinkers pivotally mounted on said bar for movement forwardly and rearwardly of said frame, each sinker having a neb and a controller thereon, a plurality of sinker needles each having one end pivotally connected to one of said sinkers and slidably mounted on said frame, a plurality of knitting needles slidably mounted on said frame, one between each pair of sinker needles, and means on said frame engaging said sinker needles and knitting needles for moving the knitting needles, sinker needles and sinkers in sequence.

3. A hand knitting machine comprising a frame, a bar mounted on the front of said frame, a plurality of sinkers pivotally mounted on said bar for movement forwardly and rearwardly of said frame, each sinker having a neb and a controller thereon, a plurality of sinker needles each having one end pivotally connected to one of said sinkers and slidably mounted on said frame, a plurality of knitting needles slidably mounted on said frame, one between each pair of sinker needles, said needles each having a butt thereon, a plate on said frame having two rows of parallel slots therein, the butts on one plurality of needles projecting through one row of slots and the butts on the other plurality of needles projecting through the other row of slots, and a carriage movable along said plate transversely of the direction of said slots and having cam means thereon engaging with the butts projecting through said slots for moving the needles in the direction of said slots.

4. A hand knitting machine as claimed in claim 3 in which said knitting needles are latch needles and said cam means has a profile which moves said knitting needles sufficiently far toward the front of said frame that the latches on said needles project completely through the fabric being knitted.

5. A hand knitting machine as claimed in claim 3 in which said knitting needles are latch needles and said cam means has a profile which moves said knitting needles sufficiently far toward the front of said frame that the latches on said needles project only partially through the fabric being knitted, the fabric resting on the turned back latch.

6. In a hand knitting machine having a frame with a bar on the front of the frame, sinkers pivotally mounted on the bar, knitting needles and sinker needles slidably mounted on the frame and cooperable with the sinkers, that improvement comprising a needle actuating means movable on said frame and engageable with the needles for moving them, said needle actuating means having cam means comprising means defining a recess having an entrance and an exit, a spring loaded pushing lever pivotally mounted on said needle actuating means and having a portion thereof over the entrance to said recess and a portion thereof over the exit from said recess, a riser cam portion on said lever adjacent the portion of said pushing lever over said entrance and forming a continuation of said portion, and a tuck cam adjacent the exit from said recess.

7. The improvement as claimed in claim 6 in which said pushing lever is spring loaded to the closed position over the entrance to said recess.

8. The improvement as claimed in claim 6 in which said pushing lever is spring loaded to the open position over the entrance to said recess.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

575,012	Sturgess	Jan. 12, 1897
1,780,975	Israelson	Nov. 11, 1930
2,719,418	Yamach	Oct. 4, 1955
2,762,213	Schurich	Sept. 11, 1956
2,909,049	Rees	Oct. 20, 1959

##### FOREIGN PATENTS

1,086,994	France	Aug. 18, 1954
-----------	--------	---------------